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PRACTICAL GENETIC ALGORITHMS

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CHAPTER 2

THE BINARY GENETIC ALGORITHM

2.1 GENETIC ALGORITHMS: NATURAL SELECTION ON A COMPUTER

The previous chapter whet your appetite for something better than the traditional optimization methods. This and the next chapter give step-by-step procedures for implementing two flavors of a genetic algorithm. Both algorithms follow the same menu of modeling genetic recombination and natural selection. One represents parameters as an encoded binary string and works with the binary strings to minimize the cost, while the other works with the continuous parameters themselves to minimize the cost. Since genetic algorithms originated with a binary representation of the parameters, it is presented first.

Figure 2.1 shows the analogy between biological evolution and a binary genetic algorithm. Both start with an initial population of random members. On the left side, each row of binary numbers represents characteristics of one of the dogs in the population. If we are trying to breed the dog with the loudest bark, then only a few of the best (in this case, four best) barking dogs are kept for breeding. Traits associated with loud barking are encoded in the binary sequence associated with these dogs. From this breeding population, two are randomly selected to create two new puppies. The puppies have a high probability of being loud barkers, because both

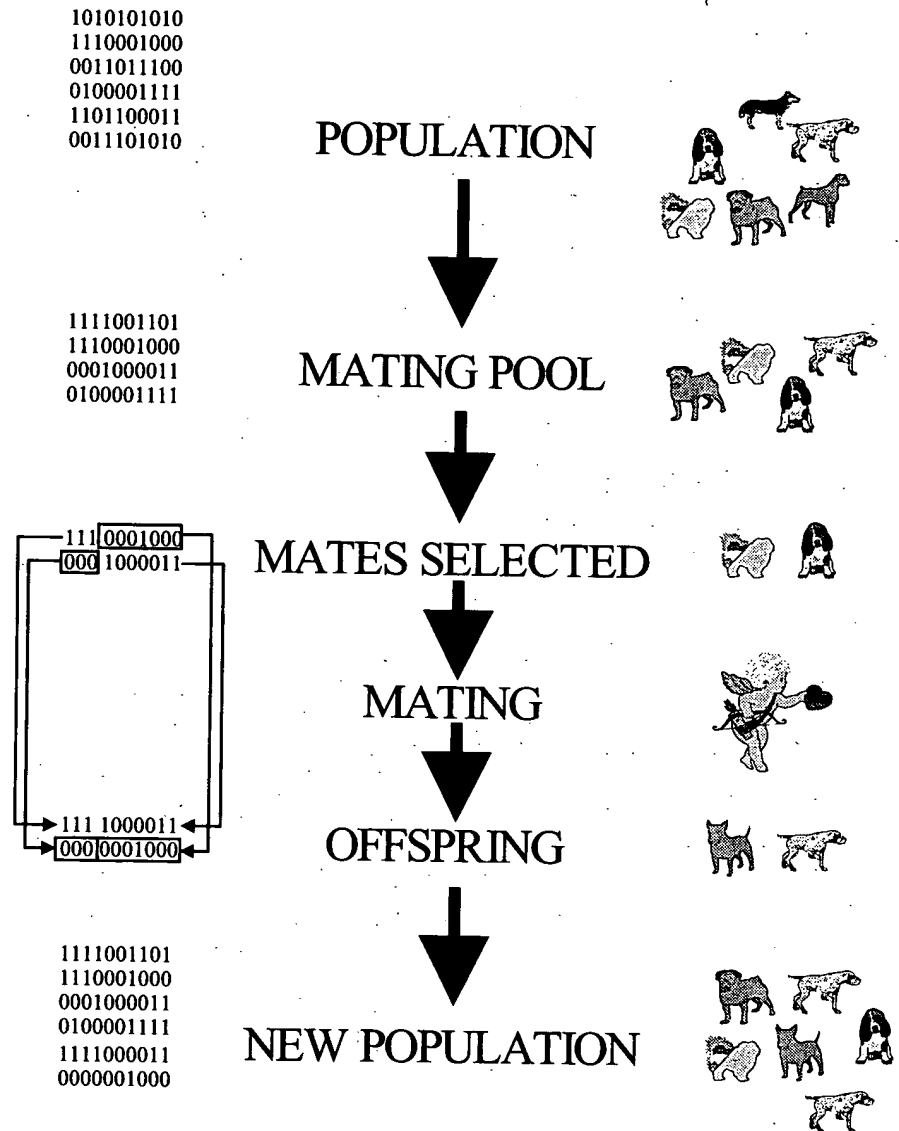


Figure 2.1 Analogy between a numerical genetic algorithm and biological genetics.

their parents have genes that make them loud barkers. The new binary sequences of the puppies contain portions of the binary sequences of both parents. These new puppies replace two discarded dogs that didn't bark loud enough. Enough puppies are generated to bring the population back

to its original size. Iterating on this process leads to a dog with a very loud bark.

2.2 COMPONENTS OF A BINARY GENETIC ALGORITHM

The genetic algorithm begins, like any other optimization algorithm, by defining the optimization parameters, the cost function, and the cost. It ends like other optimization algorithms too, by testing for convergence. In between, however, this algorithm is very different from other optimization algorithms. A path through the components of the genetic algorithm is shown as a flow chart in Figure 2.2. Each block in this "big picture" overview is discussed in detail in this chapter.

In the previous chapter, the cost function was a surface with peaks and valleys when displayed in parameter space, much like a topographic map. To find a valley, an optimization algorithm searches for the minimum cost.

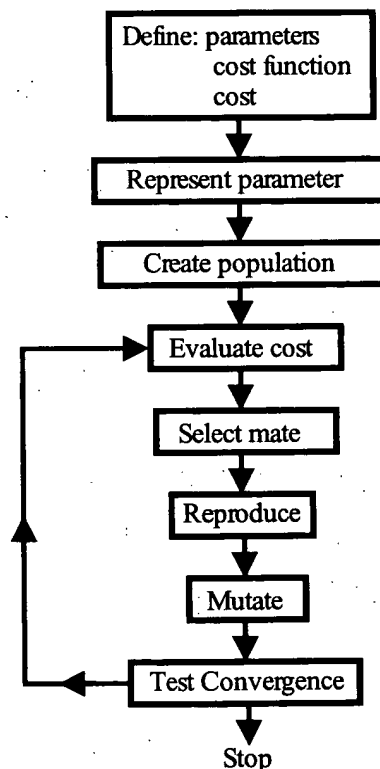


Figure 2.2 Flow chart of a binary genetic algorithm.

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